UK CLIMATE PROJECTIONS

An illustration of the effects of the revised Weather Generator

UKCP09 technical note
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Met Office Hadley Centre

UK Climate Impacts Programme

An illustration of the effects of the revised Weather Generator

In February 2011 a revised version of the Weather Generator was released. This is known as UKCP09 Weather Generator Version 2.0 and includes four main updates. These include:

- **Rainfall extremes**

  A new statistical distribution implemented to better replicate historical extreme values across the range of return periods at which it is applicable.

- **Temperature extremes**

  Improvements to heatwave duration through the addition of 3 consecutive dry days to the model.

- **Improvement in sunshine hours**

  Modifications to shorten the simulated day length to be consistent with measurements of effective sunshine.

- **Changes in sunshine and vapour pressure**

  A new baseline data set for sunshine and vapour pressure to produce more realistic changes in future projections.

This document outlines the results of implementing the revised UKCP09 Weather Generator on temperature (Table 3) and precipitation (Table 4). Both of these indices have been presented in the Weather Generator report. Each section of this note provides the changes in the tabulated indices relative to those resulting from the previous version, a commentary on what the changes are and, where possible, a potential reason for these changes.

For more information on these and other implications, as well as how they might affect your use of the UKCP09 Weather Generator, please see the UKCP09 Weather Generator guidance pages at: http://ukclimateprojections.defra.gov.uk/content/view/1206/500/

Table 3: Changes in the temperature indices as a result of the introduction of the revised UKCP09 Weather Generator.

green = increase	Observed	1961–1990			2080s Medium		
blue = decrease	50%	10%	50%	90%	10%	50%	90%
Heatwaves (2 days with Tmax > 29°C and Tmin > 15°C)							
Heathrow	0	0	0	was 0 now 1	was 0 now 1	was 4 now 7	was 26 now 22
Yeovilton	0	0	0	0	0	4	was 16 now 15
Coltishall	0	0	0	0	0	1	7
Dale Fort	0	0	0	0	0	was 1 now 0	was 5 now 3
Ringway	0	0	0	0	0	1	was 6 now 7
Aldergrove	0	0	0	0	0	0	2
Eskdalemuir	0	0	0	0	0	0	2
Wick	0	0	0	0	0	0	0
New values show very little change. The values all increase slightly at Heathrow therefore shifting the whole PDF slightly to the right rather than expanding the uncertainty range. Changes in the heatwave values at other locations are relatively small and could be explained by the random (stochastic) nature of the UKCP09 Weather Generator. The UKCP09 Weather Generator generates slightly different values each time a user runs a request because of the random selection of probabilistic change factors. There does not appear to be a spatial pattern to associate with the revised results.							
Hot days (>28°C)							
Heathrow	2	0	2	was 6 now 5	was 9 now 10	was 27 now 32	was 59 now 67
Yeovilton	1	0	was 0 now 1	was 2 now 4	was 5 now 8	was 21 now 28	was 53 now 60
Coltishall	0	0	0	was 1 now 2	2	was 10 now 11	was 34 now 35
Dale Fort	0	0	0	0	0	was 6 now 1	was 23 now 13
Ringway	0	0	0	1	was 2 now 1	9	29
Aldergrove	0	0	0	0	0	2	11
Eskdalemuir	0	0	0	0	0	was 1 now 3	was 10 now 12
Wick	0	0	0	0	0	0	was 3 now 0
The values for Heathrow, Yeovilton, Coltishall and Eskdalemuir all show shifts towards slightly larger values in the future in the revised UKCP09 Weather Generator when compared to the original. The values show a shift to the right of the PDF rather than an expanding of the uncertainty range. Dale Fort shows a decrease in the values at the 50th and 90th percentiles. This may be due to the coastal location of Dale Fort. There does not appear to be a spatial pattern to explain the results.							

green = increase	Observed	1961–1990			2080s Medium		
blue = decrease	50%	10%	50%	90%	10%	50%	90%
Hot days (> 25°C)							
Heathrow	15	was 8 now 7	was 15 now 12	was 23 now 19	was 34 now 36	was 63 now 70	was 95 now 104
Yeovilton	8	was 3 now 4	was 7 now 8	was 13 now 14	was 24 now 32	was 54 now 63	was 90 now 96
Coltishall	7	1	4	was 9 now 8	was 16 now 15	37	71
Dale Fort	0	0	0	was 2 now 0	was 8 now 1	was 25 now 12	was 54 now 40
Ringway	4	0	was 3 now 2	was 7 now 6	was 13 now 10	was 30 now 29	was 60 now 59
Aldergrove	0	0	0	2	was 2 now 3	was 11 now 13	was 31 now 34
Eskdalemuir	0	0	was 0 now 1	was 1 now 3	was 1 now 3	was 8 now 12	was 26 now 29
Wick	0	0	0	0	0	was 4 now 0	was 15 now 5
Heathrow, Yeovilton, Aldergrove and Eskdalemuir all exhibit increases in the number of hot days over 25 in the future in the revised UKCP09 Weather Generator when compared to the original. The other locations all exhibit decreases in hot days of different amounts. The values show a shift of the PDF rather than an expanding of the uncertainty range. There does not appear to be a spatial pattern to explain the results.							
Frost days (Tmin <= 0°C)							
Heathrow	39	was 26 now 27	was 41 now 37	was 56 now 51	was 3 now 2	was 12 now 9	was 27 now 23
Yeovilton	54	was 30 now 36	was 44 now 46	was 59 now 60	was 1 now 5	was 6 now 14	was 17 now 30
Coltishall	49	was 33 now 40	was 49 now 50	was 65 now 63	was 2 now 3	was 11 now 13	was 26 now 30
Dale Fort	11	was 6 now 2	was 14 now 6	was 23 now 11	0	was 4 now 0	was 11 now 3
Ringway	43	was 31 now 29	was 44 now 39	was 60 now 52	was 4 now 2	was 13 now10	was 28 now 24
Aldergrove	44	was 30 now 35	43	was 57 now 56	was 2 now 3	was 9 now 11	was 21 now 26
Eskdalemuir	94	was 80 now 84	was 98 now 97	was 115 now 112	was 10 now 19	was 27 now 40	was 51 now 66
Wick	52	was 33 now 42	was 47 now 51	was 62 now 63	was 10 now 5	was 24 now 17	was 45 now 37
Yeovilton, Coltishall, Aldergrove and Eskdalemuir all show increases in frost days in the revised UKCP09 Weather Generator. The other locations all show decreases. The values show a shift of the PDF rather than an expanding of the uncertainty range. There does not appear to be a spatial pattern to explain the results.							

green = increase	Observed	1961–1990			2080s Medium		
blue = decrease	50%	10%	50%	90%	10%	50%	90%
Annual highest Tmax (°C)							
Heathrow	29.9	was 27.8 now 27.6	was 29.5 now 29.6	was 31.7 now 31.8	31.3	was 34.7 now 34.6	was 39.2 now 39.3
Yeovilton	28.4	was 26.3 now 26.8	was 27.9 now 28.7	was 30.0 now 30.7	was 30.2 now 30.3	was 33.8 niw 33.9	was 39.2 now 39.0
Coltishall	28.0	was 25.5 now 25.7	was 27.2 now 27.7	was 29.1 now 29.6	was 29.1 now 29.2	was 32.0 now 32.2	was 36.0 now 36.2
Dale Fort	24.8	was 23.0 now 21.7	was 24.6 now 23.1	was 26.7 now 25.0	27.8	31.1	35.8
Ringway	27.6	was 25.0 now 24.6	was 26.8 now 26.6	was 29.0 now 28.9	was 29.0 now 28.9	32.1	was 36.4 now 36.5
Aldergrove	24.2	was 23.2 now 22.6	was 25.0 now 24.4	was 27.0 now 26.9	was 26.2 now 26.3	29.3	was 33.5 now 33.6
Eskdalemuir	24.8	was 22.1 now 23.2	was 23.9 now 25.4	was 26.2 now 28.0	was 25.7 now 25.6	was 29.1 now 29.0	was 33.9 now 33.5
Wick	21.6	was 20.4 now 19.7	21.8	was 23.7 now 22.5	24.5	was 27.1 now 27.0	was 30.4 now 30.2

The changes in highest maximum temperature from the original to the revised UKCP09 Weather Generator are all very minor and could be explained by the stochastic nature of the UKCP09 Weather Generator. The UKCP09 Weather Generator generates slightly different values each time a user runs a request because of the random selection of probabilistic change factors.

Table 4: Resulting changes in the precipitation indices as a result of the introduction of the revised UKCP09 Weather Generator.

green = increase	Observed	1961–1990			2080s Medium		
blue = decrease		10%	50%	90%	10%	50%	90%
Dry spells (10 day+)							
Heathrow	9	5	was 9 now 8	was 12 now 11	was 8 now 7	was 12 now 11	was 16 now 15
Yeovilton	9	4	7	10	was 6 now 7	10	14
Coltishall	8	5	was 9 now 8	was 12 now 11	7	11	was 15 now 14
Dale Fort	7	was 2 now 3	was 4 now 5	was 7 now 8	4	7	was 11 now 10
Ringway	7	2	4	7	4	7	10
Aldergrove	5	1	3	5	2	was 4 now 5	8
Eskdalemuir	4	was 0 now 1	was 2 now 3	was 4 now 5	was 1 now 2	was 3 now 4	was 6 now 7
Wick	4	1	3	was 6 now 5	2	4	7
Dry spells (20 day+)							
Heathrow	1	0	1	2	1	2	was 5 now 4
Yeovilton	1	0	1	2	0	2	4
Coltishall	1	0	1	3	1	2	4
Dale Fort	1	0	0	1	0	1	3
Ringway	1	0	0	1	0	1	2
Aldergrove	0	0	0	was 0 now 1	0	0	2
Eskdalemuir	0	0	0	was 0 now 1	0	0	1
Wick	0	0	0	was 1 now 0	0	0	1

The changes in dry spells in comparison to the original UKCP09 Weather Generator appear minor.

green = increase	Observed	1961–1990			2080s Medium		
blue = decrease		10%	50%	90%	10%	50%	90%
Rmed 1 day (Median annual maximum rainfall, mm)							
Heathrow	38	was 31 now 24	35	was 39 now 56	was 33 now 26	40	was 49 now 70
Yeovilton	33	was 32 now 26	was 34 now 35	was 37 now 55	was 34 now 29	was 39 now 42	was 48 now 70
Coltishall	35	was 31 now 24	34	was 37 now 53	was 31 now 25	was 37 now 38	was 45 now 64
Dale Fort	33	was 33 now 27	was 36 now 37	was 39 now 55	was 37 now 32	was 43 now 44	was 51 now 70
Ringway	38	was 31 now 25	34	was 36 now 51	was 32 now 28	was 38 now 40	was 45 now 65
Aldergrove	31	was 31 now 25	34	was 36 now 49	was 34 now 28	was 39 now 40	was 46 now 63
Eskdalemuir	60	was 51 now 44	was 55 now 58	was 59 now 82	was 58 now 51	was 65 now 68	was 75 now 100
Wick	29	was 29 now 22	30	was 32 now 44	was 32 now 26	was 36 now 37	was 41 now 57

All locations exhibit a wider uncertainty range both in the baseline and the future with increases in the 90th percentile values and decreases in the 10th percentile values in the future projections compared to the original UKCP09 Weather Generator.